contain the argon lines as given by Mr. Crookes; nor, with the exception of the yellow line, do I get the special lines noted by him in the gas. (Four of these out of six seem possibly to be due to nitrogen.)

But I do get lines nearly coinciding with chromospheric lines discovered by me in 1868.

On November the 6th of that year, I suspected a line less refrangible than C, and so near it that when both were showing brilliantly the pair appeared double, like D in a spectroscope of moderate dispersive power.*

Later, I discovered another line at 6678·3 (Rowland), which was observed to vary with D_3. There is a line in this position, with the dispersion employed, in the spectrum of the new gas. This line has also been seen by Thalèn, as stated by Professor Cleve in a communication to the Paris Academy ('Comptes Rendus,' April 16th, p. 835), but the other lines given by him (with the possible exception of the one at 5016) have not been recorded by me.

Although I have, at present, been unable to make final comparisons with the chromospheric lines, the evidence so far obtained certainly lends great weight to the conclusion that the new gas is one effective in producing some of them, and it is suggested by the photographs that the structure lines of hydrogen may also be responsible for some of them.

I may state, under reserve, that I have already obtained evidence that the method I have indicated may ultimately provide us with other new gases, the lines of which are also associated with those of the chromosphere.

Messrs. Fowler, Baxandall, Shackleton, and Butler have assisted me in the various stages of the inquiry.

III. "*Acokanthera Schimperi:* its Natural History, Chemistry, and Pharmacology." By Thomas R. Fraser, M.D., LL.D., F.R.S., Professor of Materia Medica in the University of Edinburgh; and Joseph Tillie, M.D., F.R.S.E., Lecturer on Experimental Pharmacology in the University of Edinburgh. Received March 28, 1895.

(Abstract.)

Several years ago an opportunity was given to one of us to examine poisoned arrows and the poison used in smearing them, of the Wa Nyika tribe of East Africa. While the pharmacological action of this poison was found to have a close resemblance to that

* 'Phil. Trans.,' 1869, p. 428.

of *Strophanthus* seeds, its physical and chemical properties enabled the conclusions to be drawn that the poison was not made from these seeds, but was chiefly composed of an extract prepared from a wood. These conclusions have been confirmed by the examination of further specimens of the Wa Nyika arrow-poison, and of the wood from which it is prepared.

Specimens of the Wa Gyriama and of the Wa Kamba arrow-poisons and of the wood from which they are prepared have also been examined.

We have been enabled to refer all these specimens of wood to the genus *Acokanthera*, which, therefore, supplies the arrow-poison used over an extensive area in East Africa.

Leaves, flowers, and fruit, each taken from the same individual tree, having also been sent to us, we have been enabled to determine that the wood of the species *Acokanthera Schimperi*, Benth. and Hook. (*Carissa Schimperi*, A.DC.), is used by the Wa Nyika and the Wa Gyriama and other tribes in preparing their arrow-poison.

The tribes inhabiting the coast regions near Mombasa have long been known to use an arrow-poison, but the botanical specimens received by us are apparently the first that have been completely identified.

The arrow-poison of these tribes usually contains a crystalline glucosidal active principle, which, in its chemical properties and pharmacological action, is identical with the active principle also separated by us from the wood of *Acokanthera Schimperi*.

This active principle crystallises from water in the form of colourless, transparent, quadrangular plates, and from alcohol in colourless, thin, needle-shaped crystals, which usually group themselves in tufts and rosettes. At a temperature of 13—15° C. it is soluble to the extent of 0·93 per cent. in distilled water, and of 2·4 per cent. in diluted alcohol of sp. gr. 0·920. At higher temperatures much larger quantities are dissolved by water and by alcohol. It is altogether insoluble in ethylic ether and in chloroform. A saturated solution in cold water is tasteless and neutral in reaction, and is affected, in an obvious manner, by very few chemical reagents. Strong sulphuric acid produces immediately a red colour, and subsequently a green colour is developed. The melting point is about 186° C. When treated with dilute sulphuric acid it gives the reaction of a glucoside.

Concordant combustions made for us by Dr. Dobbin of the Chemical Laboratory of the University show that, dried at 100° C., it contains (ii) C 58·46 per cent., H 7·71 per cent., which corresponds with the formula $C_{30}H_{48}O_{13}$.

In 1882 MM. Rochebraune and Arnaud separated an amorphous glucoside from the root of an unknown species of tree used in North

Somaliland to prepare an arrow-poison. This glucoside, dried at 120° C., on combustion yielded C 48·3 per cent., H 6·5 per cent., and to it the name ouabaïn was given.

In 1888 Arnaud obtained from the wood of an unidentified species of *Acokanthera*, provisionally named *Acokanthera ouabaïo*, Cathelineau (*Carissa ouabaïo*, Franchet and Poisson), used in North Somaliland to prepare an arrow-poison, a crystalline glucosidal active principle, which, dried at 140° C., on combustion yielded (i) C 58·14 per cent., H 7·67 per cent., corresponding with the formula $C_{30}H_{46}O_{12}$, and dried at 100° C., with the formula $C_{30}H_{46}O_{12},H_2O$; and to it the name ouabaïn was also given.

In 1893 Lewin, and also Merck, separated from the wood of another *Acokanthera*, named *Acokanthera Deflersii*, Schweinfurth, an amorphous glucosidal active principle, which, dried at 100° C., on combustion yielded C 58·32 per cent., H 8·01 per cent.; and which is also named by Lewin ouabaïn, and erroneously stated to be the active principle of *Acokanthera Schimperi*.

The complete recognition of the species of *Acokanthera* is of primary importance, because several supplies of the wood of unidentified species of *Acokanthera* sent to us from East Equatorial Africa yielded only a glucosidal active principle, which was amorphous.

The characters of the crystalline active principle which we have separated from the wood of the fully identified species *Acokanthera Schimperi*, Benth. and Hook., agree with those of the crystalline active principle separated by Arnaud from the wood of the unidentified species of *Acokanthera*, provisionally named *ouabaïo;* and also from the seeds of an unidentified species of *Strophanthus*, obtained from West Africa.

As, therefore, the name ouabaïn is used for three quite different substances, and is itself derived from merely a vernacular word "wabayo," which is used in a restricted district, we would suggest that, in accordance with a usual custom, the crystalline active principle of *Acokanthera Schimperi* should be named acokantherin and not ouabaïn.

In the Preliminary Notice of this paper there was appended a note, making brief mention of some of the most important general observations made by several investigators upon the pharmacological action of those arrow-poisons which, at the time when the investigations were made, were not known to be derived from the *Acokanthera* species, and upon several non-crystalline and crystalline glucosidal substances to which the arrow-poisons owe their action. In the present paper the work accomplished by Arnott and by Haines in 1853, by Ringer in 1880, by Rochebraune and Arnaud in 1881, by Laborde in 1887, by Langlois and Varigny, by Gley and Rondeau,

and by Gley in 1888, by Sailer in 1891, by Paschkis in 1892, and by Lewin in 1893, has been more fully described.

The group of arrow-poisons which owes its activity to extracts of *Acokanthera* plants has been found to possess a qualitative identity of action with *Strophanthus*, but some of the authors mentioned emphasise an action upon the cardio-respiratory centres in the medulla, and others a direct action upon the heart.

A detailed examination of the pharmacological action of acokantherin has not led to the discovery of any important qualitative differences between its action and that of *Strophanthus hispidus* and of its active principle strophanthin, which was described by one of us in 1870, in 1872, and in 1890.

As, however a special interest must be attached to the effects upon the circulation, the experiments upon the heart, blood-vessels, and blood-pressure are described with more detail than those upon other systems. Our experiments show that small and carefully-regulated doses can produce a great slowing of the rate of the heart, even when the vagi nerves are divided, or when atropine is administered; and that a great increase in the extent of the diastolic and systolic movements of the heart can be obtained without the average blood-pressure being at all affected, or affected only to a very small extent. Any rise of blood-pressure which follows the administration of such doses is accompanied by so great a slowing of the rate and by so great an increase of the extent of the pulse movement that constriction of blood-vessels seems contra-indicated; and the rise of blood-pressure must therefore be attributed to the increase in the amplitude and vigour of the heart movements and the greater quantity of blood propelled into the arteries. Large doses produce a rise of blood-pressure, which is probably due to an action upon the vaso-motor centres or peripheral ganglia, and probably not upon the muscle of the blood-vessels, because perfusion experiments in frogs show that dilute solutions of acokantherin of 1 in 100,000 to 1 in 10,000 in normal saline do not produce contraction of blood-vessels, and with even so strong a solution of acokantherin as 1 in 5000 the contraction is very slight; whereas a solution of digitalin of 1 in 100,000 to 1 in 20,000 in normal saline rapidly reduces and arrests the flow through the blood-vessels.

The predominant action of acokantherin is that exerted upon striped muscle, and, because of this action, with possibly an action upon the intrinsic cardio-motor ganglia, the chief effect is produced upon the heart, while the influence exerted upon the cardio-respiratory centres in the medulla is relatively slight or secondary.

IV. "The Development of *Asterina gibbosa*." By E. W. MacBride, B.A., Demonstrator of Animal Morphology to the University of Cambridge. Communicated by A. Sedgwick, F.R.S. Received March 18, 1895.

[For Abstract of this Paper see vol. 54, p. 431—"The Organogeny of *Asterina gibbosa*."]

Presents, April 25, 1895.

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